Technical Drainage Study

for

PUBLIC STORAGE - SUMMERLIN PHASE II

Date Prepared:
March 2023

Prepared for:
PS Mountain West, LLC
701 Western Ave
Glendale, CA 91201
949.413.9696

Prepared by:
Kimley-Horn and Associates, Inc.
6671 Las Vegas Boulevard South, Suite 320
Las Vegas, NV 89119
702.862.3600

Kimley»Horn

HYDROLOGIC CRITERIA AND DRAINAGE MANUAL

DRAINAGE STUDY INFORMATION FORM

Name of Development: Public Storage - Summerlin Phase II Date: March 2023

Location of Development: a) Descriptive (Cross Streets) North/South: Desert Crossing Court

East/West: Center Crossing Road

b) Section: 19 Township: 20S Range: 60E

c) APN : 138-19-419-016, 018 & 019

Name of Owner: Public Storage - Bryan Miranda

Telephone No.: 949.413.9696 Fax No.: n/a E-Mail Address: bmiranda@publicstorage.com

Address: 701 Western Ave, Glendale, CA 91201

Contact Person-Name: Rachael R. Dennis, P.E. **Telephone No.:** 702.734.5666

* **E-Mail Address:** Rachael.Dennis@kimley-horn.com **Fax No.:**

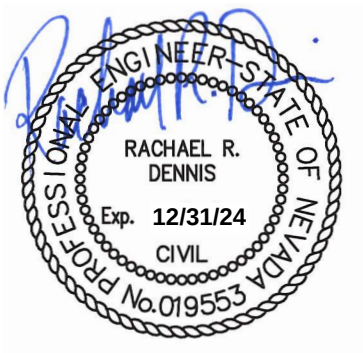
Firm: Kimley-Horn

Address: 6671 Las Vegas Boulevard South, #320, Las Vegas NV 89119

Type of Land Development/Land Disturbance Process:

	Rezoning		Subdivision Map		Clearing and Grading Only
	Parcel Map		Planned Unit Development	X	Other (Please specify below)
	Large Parcel Map	X	Building Permit		Grading Permit

1. Total Owned Land Area: At Site: +/- 7.22 ac Being Developed/Disturbed: +/- 3.66 ac
2. Is a portion or all of the subject property located in a designated FEMA Flood Hazard Area? ☐ **Yes**** ☒ **No**
3. Is the property bordered or crossed by an existing or proposed Clark County Regional Flood Control District Master Planned Facility? ☒ **Yes**** ☐ **No**
4. Proposed type of development (Residential, Commercial, Etc.): Commercial
5. Approximate upstream land area which drains to the subject site: +/- 7.11 ac
6. Has the site drainage been evaluated in the past? ☒ **YES** ☐ **NO** If yes, please identify documentation: Summ V8 CDS; Crossings Bus Cntr PHVII; Equinox Facility PHI; Nevada St Dev; JMA Arch.; Desert Crossing; Summ Pkwy Chnl; Pkwy West Office Pk
7. If known, please briefly identify the proposed discharge point(s) of runoff from the site: 1) CCRFCD Facility APSP 0069; & 2) Desert Crossing Court
8. Briefly describe your proposed schedule for the subject project: ASAP



3/28/23

Engineer's Seal

Submit this form as part of the required drainage study to the local entity which has jurisdiction over the subject property. This form may provide sufficient information to serve as the Conceptual Drainage Study.

***New Required Field**

****Review and concurrence of the Clark County Regional Flood Control District is required.**

Revision	Date

Local Entity File No.

REFERENCE:

STANDARD FORM 1

Updated 05/01/2008

Kimley»Horn

March 28, 2023

Mr. Albert Sung, P.E.
City of Las Vegas Flood Control
333 Rancho Drive
Las Vegas, NV 89106

RE: ***Technical Drainage Study for Public Storage – Summerlin Phase II***

Dear Mr. Sung,

Attached is one (1) copy of the *Technical Drainage Study for Public Storage - Summerlin Phase II* for your review. This letter certifies that all items provided on the electronic submittal (CD) match the paper version bound into the study.

With Kimley-Horn, you should expect more and will experience better. Please contact me at (702) 734-5666 or rachael.dennis@kimley-horn.com should you have any questions or concerns.

information.

Sincerely,

Rachael R. Dennis, P.E.

Kevin Hurtado, Analyst

CITY OF LAS VEGAS

MINIMUM DRAINAGE STUDY CRITERIA
STANDARD FORM 2 CHECKLIST SUPPLEMENT

(Revised 5/18/11)

The following checklist is intended as a supplemental guide for the engineer preparing a Technical Drainage Study submittal to the City of Las Vegas. This supplement focuses on requirements specific to the City of Las Vegas. The requirements presented are in addition to the Clark County Regional Flood Control District (CCRFCD) Manual Standard Form 2. The listed items are the minimum information required prior to the City performing a review. The engineer will remain responsible to ensure the Technical Drainage Study is prepared within the guidelines as set forth in the CCRFCD Hydrologic Criteria and Drainage Design Manual (Design Manual).

An appointment must be made to preview this checklist in conjunction with CCRFCD Standard Form 2 prior to the City accepting a new drainage study for review. The engineer must contact the Flood Control Section at (702) 229-6541 to schedule a submittal appointment.

If items are not applicable for the subject site, provide N/A.

I. GENERAL REQUIREMENT		
Yes	No	
	X	A notarized letter from the adjacent property owner(s) allowing off-site grading. (A copy of the letter must be received prior to final acceptance of the drainage study.) Permission to grade letters are currently in process.
X		Copies of all conditions of approval for development related to this property. (e.g. zoning, use permit, tentative map, etc.) Verify compliance with conditions.
X		An electronic copy of the complete submittal is required to be submitted with one original hard copy of the study. Electronic documents should be on a universal computer-readable digital output device replicating your submittal. An Indexed Portable Document Format (PDF) or Print Ready CAD file formats with a minimum of 300dpi are the desired formats. If figures are in color, they must be scanned in color and saved as a separate file. Rachael R. Dennis by initial here, the engineer on record acknowledges that the electronic copy is an identical replicate of the original hard copy submitted to the City of Las Vegas.

II. GRADING PLAN INFORMATION		
Yes	No	
X		(1) 24" X 36" copy of the Grading Plan, (including all Detail Sheets) sealed by the engineer.
X		Proposed future and existing spot grades for top of curbs and street crowns at lot lines, grade breaks, and along curb returns on both sides of the street. Note: Proposed top of curb elevations must be provided for both sides of roadways even if only half street construction is required.
X		Label existing topography at a minimum 5 foot elevation interval including adjacent developments, finished floor elevations of existing buildings and top of existing curbs extending 100 feet* around the perimeter of the site. (*Measured from the centerline of the adjacent roadway.)

II. GRADING PLAN INFORMATION		
Yes	No	
X		Proposed on-site and off-site storm drains and other flood control facilities with plan and profile sheets for public storm drains showing the class of pipe, (Class III, IV, V, etc.), design hydraulic grade line, (HGL) and 100 year storm flow. A public drainage easement must be provided over on-site storm drains conveying off-site flows. An overflow path must be provided over all storm drains.
X		All existing and "to be constructed" walls with cross-sections showing wall type, (e.g. block wall, retaining wall, flood wall, etc.), with limits clearly defined, adjacent ground elevations. Wall heights must meet current ordinances and in no case exceed 14 feet above the adjacent property.
X		Street slopes for both interior and perimeter streets. Note: The minimum slope for a roadway is 0.4 percent, a minimum 18-inch storm drain must be provided where minimum slopes cannot be met.
	N/A	Back of lot elevations and lot drainage pattern for all lots including common lots.
X		Sites with a grade difference two feet above or below existing ground are required to have approval from City of Las Vegas Current Planning. Current Planning approval is required prior to final approval of the drainage study.
X		On-site facilities must perpetuate flows through or around the site without significantly impacting adjacent property owners. (The project must pass flows through the site every 600 feet where the project is blocking flow paths.)
	N/A	This project uses a solid grouted stem wall (or approved alternate) at the back of sidewalk to provide erosion protection for landscaped areas where the depth of flow in the roadway exceeds the back of walk elevation. A corresponding cross-section detail is included.
X		Commercial and Common Lot Landscape areas are not allowed to drain over the sidewalk. The grading plans show flow lines with grades and sidewalk under drains for all landscape areas draining to the public ROW.

III. Local Entity Criteria - City of Las Vegas – Manual Section 1600		
Yes	No	
X		Concrete valley gutters are required in parking lots with slopes less than 1 percent. Slopes through cul-de-sac must be at a 1 percent minimum where flow is drained through the cul-de-sac.
X		Ten-foot wide public drainage easements to be privately maintained are allowed for flow less than 20 cfs. The depth of flow entering the easement must be checked using the submerged weir calculation.
	N/A	The limits of the flood zones and the base flood elevations (BFE) must be shown on all grading plans for all developments within a Special Flood Hazard Zone A, AO, AE, etc.
X		Minimum finish floor elevation is 6 inches above highest adjacent top of curb. Finish floor calculations must include allowances for super elevations on curves and velocity head for tee intersections.
X		Finished floor elevations for buildings adjacent to public drainage easements must be a minimum of 18 inches above the Q100 weir of submerged weir elevation, whichever is greater.

III. Local Entity Criteria - City of Las Vegas – Manual Section 1600		
Yes	No	
	N/A	Lots with “B and C Type Drainage” that drain from one lot to another through a drainage easement shall be required to install an underground nuisance drainage system or a 2-foot valley gutter. 16” x 24” minimum block wall openings are required for both options.
	N/A	Bubblers are required across 80 foot and greater ROW streets. When flows exceed 10 cfs, bubblers larger than 18 inches will be required up to a maximum of 36”. Inlets must be sized to match the pipe size provided.

- Contact the Flood Control Section regarding the drainage study review fee. These fees are payable at the time of submittal.
- The Drainage Study must be conditionally approved prior to submitting improvement plans to the Civil and Planning Development of the Department of Building and Safety for review.

This document is intended as an **aid** in preparing Technical Drainage Studies for the City of Las Vegas. Each study submitted is reviewed for compliance with local and regional criteria. This form is not intended to be all-inclusive and does not limit the extent of the information, calculations or exhibits which may be necessary to properly evaluate the intended land use.

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

DRAINAGE SUBMITTAL CHECKLIST

Project Name:	**Public Storage - Summerlin Phase II**	Map ID:	
Firm Name:	**Kimley-Horn**	Engineer:	**Rachael R. Dennis, PE**
Address:	**6671 Las Vegas Boulevard South, Suite 320**		
City:	**Las Vegas** State: **Nevada**	Zip:	**89119**
Phone No.:	**(702) 862-3600**	Fax No.	
Property Owner:	**PS Mountain West LLC**		
Address:	**701 Western Ave**		
City:	**Glendale** State: **CA**	Zip:	**91201**

Reviewed By:	**Date Received:**	**Date Accepted for Review:**

The following checklist is intended as a guide for the engineer preparing a Technical Drainage Study to submit to the local entity and Clark County Regional Flood Control District (if necessary). The listed items are the minimum information required prior to the entity performing a review. The engineer will remain responsible to ensure the Technical Drainage Study is prepared within the guidelines as set forth in the Clark County Regional Flood Control District (CCRFCD) Hydrologic Criteria and Drainage Design Manual (MANUAL).

This document is intended as an aid in preparing Technical Drainage Studies. Each study submitted is reviewed for compliance with local and regional criteria. This form is not intended to be all-inclusive and does not limit the extent of the information, calculations, or exhibits, which may be necessary to properly evaluate the intended land use.

If items are not applicable for the subject site, provide N/A.

I. GENERAL REQUIREMENT

YES	NO	N/A	
☒	☐	☐	Design Manual **Standard Form 1** with the Engineer's seal and signature.
☒	☐	☐	Design Manual **Standard Form 4.**
☒	☐	☐	2 copies of the 24" x 36" **Drainage Plan.**
☒	☐	☐	A notarized letter from the adjacent property owner(s) allowing off-site grading or discharge. Permission to grade letters are currently in process.

II. MAPS AND EXHIBITS

YES	NO	N/A	
☒	☐	☐	A copy of a current Flood Insurance Rate Map (FIRM) with the site delineated.
☒	☐	☐	A copy of the current CCRCD Master Plan Update Figure, (F-x), for Flood Control Facilities and Environmental areas with the site delineated.
☒	☐	☐	Off-site drainage basin maps for existing, interim, and future conditions showing the existing topography, basin boundaries, concentration points, and flows in cfs.

II. MAPS AND EXHIBITS (CONTINUED)

YES	NO	N/A	
☒	☐	☐	Vicinity Map with local and major cross streets identified and a north arrow.

III. DRAINAGE PLAN

YES	NO	N/A	
☒	☐	☐	Sheet size: 24"x36" sealed by a registered engineer in the State of Nevada.
☒	☐	☐	Minimum scale: 1"=60'
☒	☐	☐	Project name.
☒	☐	☐	Vicinity Map with local and major cross streets.
☒	☐	☐	Revision box.
☒	☐	☐	North arrow and bar scale.
☒	☐	☐	Engineer's/consultant's address and phone number.
☒	☐	☐	Elevation datum and benchmark.
☒	☐	☐	Legend for symbols and abbreviations.
☒	☐	☐	Cut/Fill scarps, where applicable.
☒	☐	☐	Street names, grades, widths.
☒	☐	☐	Proposed future and existing spot grades for top of curbs and street crowns at lot lines, grade breaks, and along curb returns on both sides of the street.
☒	☐	☐	Existing contours encompassing the site and 100-feet beyond with spot elevations for important locations, where appropriate.
☒	☐	☐	Minimum finish floor elevations with top-of-curb elevations at upstream end of lot.
☒	☐	☐	Proposed typical street sections.
☒	☐	☐	Streets with offset crowns.
☒	☐	☐	Proposed contours or spot elevations in sufficient detail to exhibit intended drainage patterns and slopes.
☒	☐	☐	Property lines.
☒	☐	☐	Right-of-way lines and widths, existing and proposed.
☒	☐	☐	Existing improvements and their elevations.
☒	☐	☐	Delineation of proposed on-site drainage basins indicating area and 10-year and 100-year peak flows at basin concentration points.
☒	☐	☐	Concentration points and drainage flow directions with Q_{100} and V_{100} and D_{100} in streets.
☒	☐	☐	Cumulative flows, velocity, and direction of flow at upstream and downstream ends of site for the 10-year and 100-year flows.
☒	☐	☐	Location and cross-section of street capacity calculations.
☒	☐	☐	Cross-sectional detail for channels, including cutoff wall locations.

III. DRAINAGE PLAN (CONTINUED)

YES	NO	N/A	
☒	☐	☐	Existing and proposed drainage facilities, appurtenances, and connections (i.e., sidewalk ditches, swales, storm drain systems, unimproved channels, and culverts, etc.) stating size, material shape, and slope with plan and profile and HGL calculations.
☒	☐	☐	Existing and proposed drainage easements and widths shown with sufficient detail. A cross-sectional detail must be provided that shows appropriate lining and reinforcement.
☐	☐	☒	Location and detail of existing, proposed, and future block wall openings. Minimum size is 16"x48". Wrought iron gate is required for flows > 10 cfs.
☒	☐	☐	Location and detail of flood-wall(s) illustrating depth of flow, proposed grouting height, etc.
☒	☐	☐	Perimeter retaining wall locations. All existing and proposed walls (retaining screen and flood) must be shown with adjacent ground elevations. Flood walls with 8-inch concrete masonry unit.
☒	☐	☐	Building and/or lot numbers.
☒	☐	☐	Alignment of all existing, proposed, or future Regional Facilities adjacent to the site.
☐	☐	☒	Limits of existing floodplain based on current FIRM or best available information; limits of proposed floodplains based on best available information.
☐	☐	☒	For areas in Zone A, AE, AH, and AO, base flood elevations (BFEs) must be shown for each lot; BFEs may be listed on each lot, or in a table. Finish floor elevations must be a minimum of 18 inches above BFE.
☒	☐	☐	Appropriately elevated "humps" 6 inches above the 100-year water surface elevation at the accesses where the intent is to protect the site from the Q_{100} flows.
☒	☐	☐	Street slopes for perimeter and interior streets. The minimum slope is 0.4 percent.
☒	☐	☐	Location and detail of best management practice (BMP) for parking lots and low impact development (LID) (if required)

IV. HYDROLOGIC ANALYSIS

YES	NO	N/A	
☒	☐	☐	Appropriate soil information and Soils Map for existing and future conditions with sub-basins and property delineated.
☒	☐	☐	Input and Output information for existing conditions from computer models (HEC-1 or TR-55). The flow routing diagram must be provided with HEC-1 models.
☒	☐	☐	Input and Output information for proposed conditions from computer models (HEC-1 or TR-55). The flow routing diagram must be provided with HEC-1 models.
☒	☐	☐	Use of correct precipitation values in and around the McCarran Airport rainfall area.
☒	☐	☐	A discussion in the text of the hydrologic analysis justifying sub-basin boundaries and cutoffs, supporting assumptions, and calculations.
☒	☐	☐	A summary table of stormwater flows showing basin area Q_{10} and Q_{100} for both individual basins and combined basin flows, where applicable.

IV. HYDROLOGIC ANALYSIS (CONTINUED)

☒	☐	☐	Copies of supporting technical information referenced from a previously approved study and a statement accepting these results.
☒	☐	☐	On-site facilities must perpetuate flows through or around the site without significantly impacting adjacent property owners in accordance with current Nevada Drainage Law.
☒	☐	☐	Calculation for impervious area for parking lots and LIDs (if required)

V. HYDRAULIC ANALYSIS

YES	NO	N/A	
☐	☐	☒	Flow split calculations and supporting documentation or reference for the method of flow calculation used.
☒	☐	☐	Normal depth street flow calculations and cross-section diagrams for all interior and perimeter streets. Provide "d x v" products for the Q_{100} and Q_{10} flows representing the worst case for interior and all perimeter streets. Q_{100} d x v ≤ 8. Q_{10} d x v ≤ 6 and 12 foot dry lane for rights-of-way ≥ 80 feet. Calculations must be labeled by street name as indicated on the **Grading Plan**.
☒	☐	☐	A summary table of interior and exterior street capacity calculations showing the street name, Q_{100} flow, slope, depth of flow, velocity and depth times velocity product and streets needing to meet 12 foot dry lane criteria.
☐	☐	☒	Appropriate hydraulic calculations for block wall openings assuming a 50 percent vertical clogging factor. (Assume the lower half of the opening is plugged.)
☒	☐	☐	Appropriate hydraulic calculations at drainage easement entrance and discharge locations to set finish floor elevations. Hydraulic calculations must include submerged weir, superelevation and tee intersection losses, where appropriate.
☒	☐	☐	Provide necessary freeboard requirements to set the finished floor elevations of all proposed buildings, 2 x depth of flow or depth of flow plus 18 inches of freeboard, whichever is less. The minimum requirement is 6 inches above adjacent upstream top of curb. Building adjacent to drainage easements must always be provided with 18 inches of freeboard above the Q_{100} weir height or flow depth, whichever is greater.
☐	☐	☒	A complete water surface profile analysis (HEC-2, HEC-RAS, etc.) for channel flows and FEMA Zone A flood zones. • Field survey data. • Input and output information. • Plotted cross-sections based on survey with proper encroachments. • A map showing the location of the cross-sections. • Analysis of both sub and super-critical flow segments. • A summary table and a discussion of the results in the text of the report.
☒	☐	☐	Provide a 50 percent clogging factor in the capacity calculation for drop inlets.
☒	☐	☐	Hydraulic calculations for culverts and storm drains. D-Load calculations must be provided for storm drainpipes in public rights-of-way, including headwater pool inundation.
☒	☐	☐	The mitigation of nuisance water, both during construction and in the fully developed condition must be addressed.
☒	☐	☐	Provide BMP type, size and supporting calculations for parking lots and LIDs (if required)

Kimley»Horn

Technical Drainage Study

for

PUBLIC STORAGE - SUMMERLIN PHASE II

Date Prepared:
March 2023

Prepared for:
PS Mountain West, LLC
701 Western Ave
Glendale, CA 91201
949.413.9696

Prepared by:
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6671 Las Vegas Boulevard South, Suite 320
Las Vegas, NV 89119
702.862.3600

March 2023
KH Project #192189003

Kimley»Horn

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INTRODUCTION

Public Storage has contracted with Kimley-Horn (KH) to provide design services for the **Public Storage -Summerlin Phase II** improvements at the northwest corner of Desert Crossing Court and Center Crossing Road, south of Summerlin Parkway (hereinafter referred to as **Phase II**). Public Storage is proposing to develop of the **Phase II (±3.66 acres)** of the ±7.22 acre **commercial site** which will include one (1) additional storage building with associated parking lots. In general, existing drainage patterns will be maintained throughout the site.

The purpose of this report is to accompany the grading plans, to provide detailed hydrologic and hydraulic analyses for the site, and to determine adequate protection for the project from offsite and onsite flows. The following tasks were performed in the preparation of this report:

1. Identify previous drainage studies for the project site and surrounding areas.
2. Identify the FEMA floodplain designation for the project site.
3. Identify existing and proposed regional drainage facilities adjacent to the site.
4. Estimate runoff generated for the peak 10-year and 100-year return period storms for existing, interim, and ultimate conditions.
5. Verify proposed finished floor elevations meet CLV Criteria.
6. Recommend drainage features to protect the project from storm runoff.
7. Determine the storm water runoff generated by the 85th Percentile Rainfall for fully developed conditions and recommend on-site water quality structural Best Management Practices (BMP) to meet Parking Lot Low Impact Development (LID) requirements.

LOCATION AND DEVELOPMENT DESCRIPTION

The project site is located in Section 19, Township 20 South, Range 60 East, M.D.M., in the City of Las Vegas, NV. The project site is composed of **APNs 138-19-419-016, -018 & -019**. A copy of the *Assessor's Parcel Map* is included in **Appendix A**. Please refer to **Figure 1 – Vicinity Map** for the location of the project.

Currently, the site is undeveloped. The site is bordered by the existing CCRFCD Angel Park-Summerlin Parkway Channel to the north, existing commercial development to the south, and Desert Crossing Court/Center Crossing Road to the southeast. Development west and east of the project site is currently ongoing. The existing site is comprised of undeveloped desert terrain with sparse vegetation. The existing site generally slopes from the southwest to the northeast via natural washes into existing storm drain or into the existing CCRFCD Channel located directly north of the project site. Drainage improvements will include swales, valley gutters, and storm drain facilities designed to convey and onsite storm runoff through the site and into the existing CCRFCD concrete-lined trapezoidal channel (APSP 0069) that conveys flows east along the southern border of Summerlin Parkway.

FIGURE 1 - VICINITY MAP

PUBLIC STORAGE - SUMMERLIN PHASE II

Kimley»Horn

LAND USE CONDITIONS

The project site has a zoning classification of **Planned Community District (P-C)**. The current Notice of Final Action (NOFA) is included in **Appendix A**. The project site plan was approved by the Summerlin Non-Residential Design Review Committee (SNRDRC). Therefore, the proposed improvements are consistent with the approved zoning. A copy of the December 6, 2021 approval letter has been included in **Appendix A**.

PREVIOUS DRAINAGE STUDIES

Previous hydrology studies and plan sets that were utilized in the preparation of this report:

1. *Technical Drainage Study for Public Storage at Summerlin* (Public Storage Study, July 2021, DS5447C)

    a. Establishes drainage patterns for the project site. Flows from the *Public Storage Study* are collected and conveyed by the **existing 24" RCP storm drain** system that ultimately outlets into the existing Angel Park – Summerlin Parkway Channel **CCRFCD Facility APSP 0069** located north of the project site. Hydrology has been referenced and/or revised (reflecting current conditions) with this study. The *Public Storage Study* existing 24" RCP storm drain is located between the existing Building 1 and proposed Building 2. **Phase II** proposes to extend an additional **18" RCP lateral** which will discharge directly into the existing 24" RCP storm drain system. The existing 24" RCP storm drain was designed to collect and convey 22 cfs (CP1). Due to added shared driveway at the northwest corner of the proposed site between existing Building 1 and proposed **Building 2**, flows collected by the existing 24" RCP have been reduced by 2 cfs, for a total flowrate of **20 cfs** discharging into **Facility APSP 0069;** therefore, the proposed **Phase II improvements will not adversely impact the existing 24" RCP storm drain system.** Since the improvements for the *Public Storage Study* development will be constructed prior to and/or concurrently with the **Phase II** development, the improvements for the *Public Storage Study* development are considered existing.

2. *Parkway West Office Park Improvement Plans* (Office Park Plans, September 2022, Plan #107-V9536)

    a. The *Office Park Plans* include the development directly east of the proposed **Phase II** improvements. The *Office Park Plans* show an interim unlined trapezoidal channel and berm along the **Phase II** site eastern property line which collects and conveys offsite flows outletting directly into the existing Angel Park – Summerlin Parkway Channel **CCRFCD Facility APSP 0069** located north of the project site. A proposed 2-foot-deep v-ditch will replace the existing interim channel/berm system to accommodate the proposed **Phase II** improvements. Since the improvements for the *Office Park* development will be constructed prior to and/or concurrently with the **Phase II**

development, the improvements for the *Office Park* development are considered existing.

2. *Technical Drainage Study for The Crossings Business Center Phase VII* (Crossings Phase VII Study, September 2004, DS2950) and *Technical Drainage Study for Desert Crossing Road in the Crossing Business Center* (Road Study, January 1997, DS1843)

    a. The *Crossings Phase VII Study* included construction of drop inlets and laterals at the northern end of Desert Crossing Court. The *Crossings Phase VII* Study provided an **existing 24" RCP lateral stub** on the north and an **existing 30" lateral stub** on the south for the project site to connect to and ultimately discharge into the existing **CCRFCD Facility APSP 0069** channel. The existing laterals have been extended onsite to collect and convey flows generated by the **Phase II** development.

    b. The *Road Study* includes the street improvement plans for Desert Crossing Court (formerly Desert Crossing Road). The existing storm drain in Desert Crossing Court ranging in size from a 24" RCP to a 36" RCP was designed to collect and convey **68 cfs** flows from the existing offsite developments and the proposed project site. Due to the proposed **Phase II Building 2** stepped finished floor, flows collected by the existing 36" RCP have been increased by 1 cfs, for a total flowrate of **69 cfs** discharging into **the existing 36" RCP.** The increase to the storm drain system is considered minor therefore, the proposed **Phase II improvements will not adversely impact the existing 36" RCP storm drain system.**

Kimley-Horn has reviewed the reference studies and plan sets listed and agrees with the information included therein. The information referenced is for determining the existing and future development patterns and quantities of flow adjacent to the proposed project site. Flows referenced are indicated throughout this report and are accepted by Kimley-Horn for this study. Pertinent reference material is included in **Appendix E**.

CLARK COUNTY REGIONAL FLOOD CONTROL DISTRICT (CCRFCD) MASTER PLAN FACILITIES

"*The Las Vegas Valley Flood Control Master Plan Update*", **Figure F-23**, dated December 2018, as prepared by the Clark County Regional Flood Control District (CCRFCD) illustrates the existing and proposed master planned facilities in the area (**See Appendix A**). As shown on the figure, the project site is located adjacent to the existing **CCRFCD Angel Park – Summerlin Parkway Facility APSP 0069** located north of the project site. CCRFCD Facility APSP 0069 consists of a 6-foot-deep trapezoidal concrete-lined channel with a 10-foot-wide bottom width and 2:1 side slopes which conveys a total 100-year flowrate of 1,666 cfs. Flows generated onsite will discharge directly into the existing channel via propose onsite or offsite storm drain facilities.

FLOOD HAZARD DESIGNATION

The Special Flood Hazard Areas (SFHA) for both the unincorporated and the incorporated portions of Clark County, Nevada, are outlined in the Federal Emergency Management Agency (FEMA) Flood Insurance Rate Maps. This subject site is located on FEMA Flood Insurance Rate Map (FIRM) Community Panel No. **325276 2150E**, revised September 27, 2002. As shown on our FEMA FIRM Exhibit (see **Appendix A**), the subject site is located within a FEMA-designated **Zone X.** Areas described as Zone X are areas determined to be outside the 0.2% annual chance flood plain (500-year).

HYDROLOGIC METHODOLOGY

The hydrologic model and design of this site development are in compliance with local requirements, including City of Las Vegas (CLV), the CCRFCD's "*Hydrologic Criteria and Drainage Design Manual*", and the CCRFCD's "*Flood Control Master Plan Update*".

MODEL DESCRIPTION

The hydrologic model utilized in this study is the **HEC-1** Flood Hydrograph Package developed by the U.S. Army Corps of Engineers Hydrologic Engineering Center. **HEC-1** is a rainfall runoff event simulation model utilizing an interconnected system of hydrologic and hydraulic components to stimulate the surface runoff response of a drainage area to precipitation. The calculations of this study were performed using the SCS Unit Hydrograph of the HEC-1 Flood Hydrograph Model. The detailed explanation of the theory and background is presented in Section 4 of the SCS National Engineering Handbook and the **HEC-1** User Manual. Since the drainage area for the overall watershed is less than 8 square miles, and **SDN3** design storm was selected for the use in the HEC-1 computer model.

PRECIPITATION

According to Figure **513** of the Manual, the project is **not** located within the McCarran Airport Rainfall Area. Therefore, the precipitation values for the 10-year and 100-year, six-hour storm event were adjusted per **Table 501** and calculated to be **1.74** inches and **3.00** inches, respectively. S**ee Figures 503** and **506** in **Appendix E**.

CURVE NUMBER

The soils information for the project watershed was referenced from the Soil Survey of Las Vegas Area, Nevada, Part of Clark County" prepared by the United States Department of Agriculture Natural Resources Conservation Services (USDA NRCS). A *Custom Soil Resource Report* for the project site is included in **Appendix E**. The report shows that the project area and offsite subbasins consist of Soil Type 502 (Canutio-Cave gravelly fine sandy loam). Soil Type 502 is classified as Hydrologic Soil Group (HSG) Type "A" with low runoff potential.

The land uses / Land covers for the project site consist of "**Commercial**" for developed areas.

For the given soil, CN values were determined from appropriate columns of **Table 602** of the Manual. A curve number of **91.4** was determined for the proposed conditions subbasins which is consistent with the referenced *Public Storage Study*.

A copy of "*The Las Vegas Valley Flood Control Master Plan Update"*, Figure **W-4**, dated December 2018, as prepared by CCRFCD is included in **Appendix A** to illustrate Regional's hydrologic subareas, land use and soils in the area.

DRAINAGE AREAS AND FLOW PATTERNS

The subbasins and flow patterns used for the hydrologic modeling were determined from elevations established for the project site in a master grading digital file. Aerial topography with 1-foot contour intervals and survey data has been used for subbasin delineations.

LAG TIME

The time between a brief, heavy rain and maximum runoff rate is called Lag Time. Lag Time can be estimated from historical hydrographs, or it can be estimated from specific watershed characteristics such as watershed length, slope and flow impedance. Based on studies of many storm events for a range of watershed conditions, the following empirical relationship between Lag Time (T) and Time of Concentration (T_c) was derived:

$$T = 0.6T_c$$

The Time of Concentration (T_c) is defined as the time required for runoff to the flow from the most remote part of the drainage basin to the outlet or to a combination point. The procedure for calculating the T_c is outlined in **Section 602** of the Manual. Lag time calculations for this site are included in **Appendix B** as shown on Standard Form 4.

HYDROLOGY

Proposed conditions hydrology has been prepared to address the proposed onsite improvements. Proposed Conditions subbasins have been included on **Figures PRO**, respectively, and depict the drainage patterns used in the hydrologic analysis for this project. Copies of the figures are included in **Appendix A**. Hydrologic calculations are included in **Appendix B**. The HEC-1 Model for the Proposed Conditions subbasins has been included in **Appendix B**. Tables summarizing the results of the HEC-1 Models have been included on **Figure PRO** in **Appendix A**.

EXISTING CONDITIONS

Existing conditions assume the site undeveloped, and the surrounding areas as fully developed. Offsite flows are conveyed within existing adjacent roadways and storm drain systems and do not impact the project site. The existing *Public Storage Study* development west of the project site collects and conveys offsite flows within the existing 24" RCP storm drain system away from the **Phase II** development and into the **CCRFCD Facility APSP 0069** north of the project site. Offsite flows in Desert Crossing Court **(27.5 cfs)** will be collected and conveyed by the existing 36" RCP along the eastern boundary of the proposed site. Flows generated onsite are conveyed northeast via onsite natural washes and into the **CCRFCD Facility APSP 0069** north of the project site. The existing and proposed drainage patterns the **Phase II** development were addressed in the *Public Storage Study*. The *Public Storage Study* determined that the development of **Phase II** will not adversely impact existing downstream facilities. Additionally, onsite mitigation measures have been provided to limit the impacts of the proposed development on existing roadways and storm drain systems. Therefore, a site-specific existing condition hydrologic analysis is not necessary for this study.

PROPOSED CONDITIONS

The proposed drainage patterns assume the site as described in existing conditions with the proposed site and offsite parcels as fully developed. See **Figure PRO** in **Appendix A**.

The project-specific proposed conditions hydrology consists of three onsite subbasins (**ON1, ON2 & ON3**), offsite subbasins referenced from the *Public Storage Study.* **Figure PRO** depicts the subbasins and drainage patterns used in the proposed conditions hydrologic analysis for this project. Note that the design of all onsite drainage facilities has been based on proposed conditions flow rates since they represent the worst-case flows. The subbasins and flow patterns used to determine the onsite flowrates impacting the proposed improvements were prorated. A unit flowrate (cfs/acre) for the onsite subbasin was calculated by dividing the total flowrate of the subbasin by the overall subbasin area. The total flowrate generated by the areas shown on **Figure PRO** is approximated by multiplying the calculated unit flow rate (cfs/acre) by the delineated portion of tributary area (acres). Prorate calculations for the onsite subbasins have been included on **Figure PRO**. **Table 3** summarizes the prorated proposed conditions flowrates for subbasins and swales. Hydrologic calculations have been included in **Appendix B**. Hydrologic calculations have been included in **Appendix B**. **Table 1** summarizes the HEC-1 results for proposed conditions.

Table 1: Proposed Condition Flow Summary

BASIN ID/ COMB. PT.	BASIN AREA (ac)	100-YR FLOW (cfs)	10-YR FLOW (cfs)
B (2*)	2.18	9	5
*OF1	1.1	3	2
ON1	2.65	8	4
CP1	-	20	10
A (2*)	3.98	13	6
ON2	0.97	4	2
ON3	2.60	8	4
CP2	-	12	6
^CPSD	-	69	10

* Referenced/Revised from the *Public Storage Study*.
^CPSD combines 1cfs (1*) + 3.5cfs (3*) + 3.5cfs (3*) + 5cfs (4*) + 31cfs (5*) + A (2*) + CP2

Table 2 Proposed Condition Prorated Flow Summary

Subbasin*	Q_{100} (cfs)	Area (acres)	Q100 (cfs/acre)
*OF1	3.0	1.06	2.83
ON1	8.0	2.65	3.02
ON2	4.0	0.97	4.12
ON3	8.0	2.60	3.08
Subbasin*	Q_{100} (cfs)	Area (acres)	Q100 (cfs/acre)
*OF1-A	<1	0.04	2.83
*OF1-B	0.5	0.20	2.83
*OF1-C	2.5	0.82	2.83
TOTAL	**3.0**	**1.06**	**NA**
ON1-A1	2.0	0.65	3.02
ON1-A2	1.5	0.48	3.02
ON1-B	2.0	0.60	3.02
ON1-C	<1	0.11	3.02
ON1-D	1.0	0.28	3.02
ON1-E	1.0	0.40	3.02
ON1-F	0.5	0.13	3.02
TOTAL	**8.0**	**2.65**	**NA**

Subbasin*	Q_{100} (cfs)	Area (acres)	Q100 (cfs/acre)
*OF1	3.0	1.06	2.83
ON1	8.0	2.65	3.02
ON2	4.0	0.97	4.12
ON3	8.0	2.60	3.08
Subbasin*	Q_{100} (cfs)	Area (acres)	Q100 (cfs/acre)
ON2-A	2.5	0.60	4.12
ON2-B	1.0	0.30	4.12
ON2-C	0.5	0.07	4.12
TOTAL	**4.0**	**0.97**	**NA**
ON3-A	4.0	1.18	3.08
ON3-B	3.0	1.07	3.08
ON3-C	0.5	0.19	3.08
ON3-D	0.5	0.16	3.08
TOTAL	**8.0**	**2.60**	**NA**

* Referenced/Revised from the *Public Storage Study*.

Flows collected onsite will be discharged into proposed onsite storm drain laterals that outlet directly into the existing *Public Storage Study* 24" RCP collection system and the existing 36" RCP collection system which ultimately outlet flows into the existing **CCRFCD Facility APSP 0069** located north of the project site. See **Figure PRO** in **Appendix A**.

Flows generated by the referenced/revised offsite and onsite subbasins will discharge at two (2) locations:

1) **Existing CCRFCD Facility APSP 0069 (Concrete Channel, 6' D, 10' W, 2:1 SS);**

   There is an existing onsite storm drain system which was proposed by the *Public Storage Study*, where the proposed onsite storm drain system will connect to and discharge to the Channel. Onsite Subbasin **ON1** will be collected and conveyed north by a proposed onsite storm drain facility that will discharge directly into the existing **CCRFCD Facility (APSP 0069)** north of the project site similar to existing conditions. The proposed site and storm drain have been designed to collect and convey the 100-year storm event. Proposed flows discharging at this location is not anticipated to adversely impact downstream facilities. A detailed description of the proposed onsite storm drain system hydraulics is included in *Storm Drain Facilities and Protection* Section of this report. See **Appendix C** for the storm hydraulic calculations.

2) **Desert Crossing Court;**

The onsite Subbasin **ON2-B & ON2C** surface flow into Desert Crossing Court. Subbasin **ON2-A** will be intercepted by a proposed onsite storm drain lateral that connects to an existing 30" lateral stub. Flows in Desert Crossing Court will drain north and away from the project site to the existing drop inlet located at the end of the street. Flows collected by the existing drop inlet will be conveyed north within the existing 36-inch RCP storm drain system which ultimately discharges into the existing CCRFCD Facility (APSP 0069). The existing 36" RCP Storm Drain system has been designed to collect and convey a total flowrate of 68 cfs, and the existing drop inlet in Center Crossing Road was designed to collect and convey 42 cfs; therefore, the proposed conditions surface flowrate in Desert Crossing Court (27.5 cfs) and the flows conveyed by the storm drain system will not adversely impact downstream facilities or properties. See **Appendix C** for the hydraulic calculations and **Appendix E** for any referenced hydraulic calculations.

HYDRAULIC CALCULATIONS

STREETS

The resulting street flow data based on the flows generated during proposed conditions has been presented in **Tables 4** and **5**. **Figure PRO** in **Appendix A** show the locations of the cross sections corresponding to the calculations included in **Tables 4** and **5**. Hydraulic calculations have been included in **Appendix C**. The onsite normal depth sections and flow rates have been calculated from their respective tributary subbasins. Desert Crossing Court is an existing private street with L-type curb and gutter and sidewalk on both sides within a 50-foot-wide right-of-way measured from back of sidewalk to back of sidewalk. Flows in Desert Crossing Court have been referenced from the adjacent developments and will combine with a portion of the flows generated onsite to be conveyed north within the roadway alignment away from the project site to be collected and conveyed by the existing drop inlet and existing 36-inch RCP storm drain system.

Table 4: Proposed Offsite Roadway Hydraulic Sections

STREET SECTION	TRIBUTARY BASINS	SLOPE (%)	Q_{100} (cfs)	FLOW DEPTH (ft)	VELOCITY (ft/s)	D*V ft^2/s
ST-1	1cfs (1*) + 3.5cfs (3*) + 3.5cfs (3*) + 5cfs (4*) + A (2*) + ON2-B + ON2-C	3.10	27.5	0.47	4.94	2.32

Table 5: Proposed Condition Onsite Flow Summary

ONSITE SECTION	TRIBUTARY BASINS	CHNL SLOPE	Q_{100}	FLOW DEPTH	FLOW LINE	FLOW LINE + 2D	FFE BLDG 1	FFE BLDG 2	BLDG 1 PROTECTED?	BLDG 2 PROTECTED?
		%	(cfs)	(ft)	(ft)	(ft)	(ft)	(ft)		
ON1-A1	ON1-A1 + ON1-A2	1.90	3.5	0.20	28.99	29.39	29.89	32.20	YES	YES
ON1-A2	ON1-A2	1.50	1.5	0.15	31.61	31.91	29.89	32.20	-	YES
ON1-B1	ON1-B	0.40	3.5	0.25	28.69	29.19	29.89	30.85	YES	YES
ON3-A1	ON1-C	5.71	4.0	0.31	21.13	21.75	-	19.85	-	*
ON3-B1	ON1-I	0.97	3.5	0.38	17.80	18.56	-	19.85	-	YES
ON2-B1	ON2-B	4.92	2.5	0.28	32.76	33.32	-	32.2	-	*NO

*Structural floodproofing provided a minimum 1.5' above water surface elevation and to bottom of building footing
**Add 2800 ft

Based on the calculated flow characteristics, the Manual criteria for depth (D) and velocity times depth (V*D) during the 100-year storm event will be met.

STORM DRAIN FACILITIES AND PROTECTION

The proposed flood control facilities for the site include ditches, storm drain, and drop inlets. Facility names for the onsite and offsite facilities in the calculations correspond with the tributary prorated subbasin and the facility location. All existing and proposed flood control facilities have been shown on **Figure WSPG** and the plans included in **Appendix F**. All proposed facilities have been sized to convey the proposed conditions flowrates. Proposed drop inlets have been sized to collect flows and discharge them into the proposed mainline and lateral storm drain systems. Proposed WSPG calculations for the proposed storm drains have been included in **Appendix C**. The **Public Storage** Storm Drain System (**PSTORAGE.WSW**) was modeled in WSPG using a starting HGL of **2815.32 feet** (referenced from the *Public Storage Study*) conservatively based on a normal depth calculation for the existing **CCRFCD Facility (APSP 0069)** which references the 2018 MPU flowrate of 1,666 cfs. Copies of the calculations have been included in **Appendix C**. Pertinent reference material has been included in **Appendix E**. Flows collected onsite will ultimately drain into the existing **CCRFCD Facility (APSP 0069)**. Please refer to **Figure WSPG** for facility flows and sizes located in **Appendix A**. The HGL for the existing storm drain systems and proposed laterals have been designed to be at least 1-foot below existing finished grade. Copies of the calculations have been included in **Appendix C**. The proposed storm drain systems are designed to intercept and convey all onsite nuisance and storm flows up to a 100-year storm event.

DROP INLETS

Facility names for the proposed drop inlets in the calculations correspond with the tributary prorated subbasin and the facility location. Information for the drop inlets has been included on **Figure PRO.** All drop inlet calculations which include a 50 percent clogging factor, have been included in **Appendix C**. The proposed storm drain systems are designed to intercept and convey all onsite nuisance and storm flows up to a 100-year storm event.

In the unlikely event the drop inlets at the proposed low points become completely clogged, emergency overflow paths have been provided to protect the adjacent finished floors. Normal depth calculations for the emergency overflow paths have been included in **Appendix C**. Emergency overflow paths have been provided at the following locations:

1. Cross Section East of Existing Building 1 and West of Proposed Building 2 – The emergency overflow path for the drop inlet located at the low point in the swale east of the existing Building1, is provided east and north between the existing and proposed buildings. Emergency overflows at this location will spill to the north and then east within the northern **Phase II** drive aisle and ultimately north into the existing **CCRFCD Facility APSP 0069**. An emergency overflow normal depth calculation has been included in **Appendix C**. Please note that this is an emergency overflow condition only and the proposed systems are designed to intercept and convey all onsite nuisance and storm flows up to a 100-year storm event.

PARKING LOT LOW IMPACT DEVELOPMENT (LID)

Per Section 1502.2 of the CCRFCD "Hydrologic Criteria and Drainage Design Manual", this project is categorized as a **Large Parking Lot** since the size of the on-site parking lot is approximately +/-2.61 acres.

For the Large parking lot category, BMPs are required to treat storm water runoff from at least 75 percent of the parking lot. BMPs are sized for the 85th Percentile Rainfall. Please refer to **Appendix D** for all LID calculations and for **Figure LID – LID Basin Map**.

Three (3) types of BMP are incorporated into the project design: CDS hydrodynamic separator, media filters landscaped swales. Due to site design and grading constraints, the project site was delineated into four (4) sub-areas; Drainage Management Areas (DMA) A, B, C, and D.

DMA A will be treated by **landscaped swales.** The swales are designed with a minimum length of 40 feet long and a slope of 1.00%. The proposed swales are rock-lined (d50=6-inches; thickness=12-inches) and treat more than 75% of the parking lot area. Based on hydraulic analysis, these swales will convey, contain, and treat the peak BMP discharge (QBMP) as well as facilitate the 100-year peak flow rate; this calculation is included in **Appendix D**.

DMA C will be treated by **REM-FOG TRITON – TR Drop Inlet Series Media Filters**. The REM-FOG TRITON -TR Filter is a multipurpose catch basin insert designed to capture sediment, trash, debris, suspended solids, oils & grease and other storm water pollutants. The proposed media filters will treat more than 75 percent of the parking lot area. Per the REM Specifier Chart for the TRITON Drop Inlet Filter, these media filters will convey, contain, and treat the peak BMP discharge (QBMP) as well as facilitate bypass of the 100-year peak flow rate. A copy of the size, media filtered flow rate, 100-year bypass flow rate and debris holding capacities are included in **Appendix D**. The proposed **LID Basin Map** is included in **Appendix D**. The proposed BMPs are shown on the grading plan included in **Appendix E**.

DMA B and D are treated via **CDS hydrodynamic separator** from the storm drain system. The CDS separator is a multipurpose structure designed to capture sediment, trash, debris, suspended solids, oils & grease and other storm water pollutants. The proposed **LID Basin Map** is included in **Appendix D**. The proposed BMPs are shown on the grading plan included in **Appendix F**.

FINISHED FLOOR ELEVATION

The proposed site will meet the CCRFCD criteria for finished floor elevations. The Clark County Regional Flood Control District requirement for the finish floor elevation (FF) is that it must be 18 inches above the centerline grade of the adjacent street or be elevated to twice the depth of flow up to 18 inches above the water surface elevation (WSE). Additional criteria requires the finished floor elevation to be 6 inches above adjacent on-site flowline high point.

Where finished floors do not meet the above-mentioned criteria based on elevations of the adjacent drive aisles and swales, structural floodproofing will be provided for finished floor elevation protection. Additionally, the proposed flowline high point located east of existing Building 1 is less than 6-inches below the existing finished floor. As discussed with CLV, there is no flow in this location and the adjacent storm drain systems have been provided to protect the existing and proposed finished floor elevations. The proposed buildings are set above at least twice the depth of flow in the adjacent drive aisles. Please note that existing and proposed offsite and onsite storm drain systems have been provided to collect and capture offsite and onsite flows. Please refer to the grading plans included in **Appendix F**.

CONCLUSIONS AND RECOMMENDATIONS

The proposed Phase II development will not adversely impact the surrounding areas in both the 10-year and 100-year storm events. The development of this project site is in compliance with the *CCFCD Hydrologic Criteria and Design Manual* and City of Las Vegas criteria.

1. This project is in compliance with the applicable drainage laws recognized by the State of Nevada.

2. This project is in compliance with the CCRFCD's "*Master Plan Update*" and will **not** conflict with any Master Planned Facilities.

3. This project is in compliance with the CCRFCD's "*Hydrologic Criteria and Drainage Design Manual*", with the exceptions noted in the study.

4. This project lies within FEMA-designated **Zone X**. Therefore, the project is not currently located in a FEMA-designated Special Flood Hazard Area.

5. The drainage facilities for this project have been designed to control and convey the onsite runoff from the 100-year storm safely around the site. In addition, they have been designed based upon generally accepted engineering practices and in accordance with local requirements.

6. Existing offsite storm drain systems will collect and convey offsite and onsite flows north into the existing **CCRFCD Facility APSP 0069.** The proposed site and storm drain have been designed to collect and convey the 100-year storm event. Onsite flows that discharge east into Desert Crossing Court will be collected and conveyed by the existing 24-inch RCP and 36-inch RCP storm drain systems that ultimately discharges north into existing **CCRFCD Facility APSP 0069.**

7. The finished floor elevations meet the minimum requirements and are adequately protected from offsite and onsite flows.

8. Runoff generated from, or conveyed by, the project will not adversely impact any downstream properties or facilities.

REFERENCES

1. Clark County Regional Flood Control District, "*Hydrologic Criteria and Drainage Design Manual*," August 1999, Revise September 2013.

2. Clark County Regional Flood Control District, "*2018 Las Vegas Valley Flood Control Master Plan Update*," November 2018.

3. U. S. Department of Agriculture Soil Conservation Service, *Soil Survey of Las Vegas Valley Area, Nevada, Part of Clark County*, June 2020, Version 15.

4. U.S. Army Corps of Engineers. HEC-1 Flood Hydrograph Package. Revised June 1998.

5. *Technical Drainage Study for Public Storage at Summerlin* (Prepared by Kimley-Horn, July 2021)

6. *Technical Drainage Study for Parkway West Office Park* (Prepared by DRC, September 2022)

7. *Update to the Technical Drainage Study for The Crossings Business Center Phase VII* (Prepared by Carter Burgess, November 2004)

8. *Technical Drainage Study for Desert Crossing Road in the Crossing Business Center* (Prepared by GCW, January 1997)

Kimley»Horn

LIST OF APPENDICES

Appendix A – Documents & Figures

- PRO Proposed Condition Basin Map
- WSPG WSPG Exhibit
- Assessor's Parcel Map
- FIRM Exhibit
- Figure F-23 Flood Control Facilities
- Figure W-2A Hydrologic Subareas, Land Use & Soils
- NOFA (21-0793-CRG1)
- SNRDRC Approval Letter

Appendix B – Hydrologic Parameters & HEC-1 Analyses

- Proposed Condition Standard Form 4
- Proposed Condition HEC-1 Output

Appendix C – Hydraulic Calculations

- Normal Depth Calculations – Streets
- Normal Depth Calculations – Onsite
- Normal Depth Calculations – Emergency Overflow
- Normal Depth Calculations - Swales
- Hydraulic Analysis Report
- Grate Calculations
- Drop Inlet Calculations
- WSPG Models
  - PStorage Mainline & Lateral (PSTORAGE.WSW)
  - Crossings Mainline & Laterals (CROSSING.WSW)
- D-Load Calculations

Appendix D – Parking Lot LID Calculations

- LID Parking Lot LID Map & Calculations
- REM TRITON – TR Drop Inlet Series Filters
- CDS Detail

Appendix E – Reference Materials

- *Technical Drainage Study for Public Storage at Summerlin (*Phase I Study, July 2021)
- *Technical Drainage Study for Parkway West Office Park* (Office Park Study, September 2022)
- *Update to the Technical Drainage Study for The Crossings Business Center Phase VII (*Crossings Phase VII Study, November 2004)

- *Technical Drainage Study for Desert Crossing Road in the Crossing Business Center* (Road Study, January 1997)

Appendix F – Improvement Plans

Appendix G – Data CD